

**IN THE CLAIMS:**

- 1 1. (Amended) An electronic system, comprising a single device and an external  
2 magnetic field, said single device having a light emitting portion, a magnetically  
3 sensitive portion, and an energy barrier, wherein an interface is between said  
4 magnetically sensitive portion and said light emitting portion, further wherein said  
5 energy barrier is between said magnetically sensitive portion and said light emitting  
6 portion, wherein said external magnetic field is aligned parallel to said interface  
7 where said external magnetic field intersects said magnetically sensitive portion,  
8 wherein a change in said external magnetic field is capable of changing  
9 magnetization of said magnetically sensitive portion in a direction parallel to said  
10 interface, wherein said change in magnetization of said magnetically sensitive  
11 portion is capable of modulating a hot electron current flowing across said energy  
12 barrier to said light emitting portion for modulating light emission from said light  
13 emitting portion.
  
- 1 2. (Amended) An electronic system, as recited in claim 1, wherein said single device is  
2 for converting a magnetic digital signal directly into an optical digital signal, wherein  
3 variation of said external magnetic field provides said magnetic digital signal.
  
- 1 3. (Previously presented) An electronic system, as recited in claim 2, wherein said  
2 single device is for converting said magnetic digital signal to both an electrical  
3 digital signal and into said optical digital signal, wherein either or both of said  
4 signals can be provided as a device output.
  
- 1 4. (Original) An electronic system, as recited in claim 1, wherein said magnetically  
2 sensitive portion comprises a magnetically permeable material.

- 1 5. (Previously presented) An electronic system, as recited in claim 1, wherein said  
2 single device includes a three-terminal light-emitting transistor, said transistor  
3 having an emitter, a base, and a collector, wherein said light is emitted from said  
4 collector.
- 1 6. (Previously presented) An electronic system, as recited in claim 2, wherein said  
2 magnetically sensitive portion includes a magnetic switch, wherein switch position is  
3 determined by said magnetic digital signal, wherein a first intensity of light is  
4 emitted in a first switch position and a second intensity of light is emitted in a second  
5 switch position, wherein said first intensity is greater than said second intensity.
- 1 7. (Previously presented) An electronic system, as recited in claim 5, wherein said  
2 transistor comprises ballistic spin filtering to spin polarize and analyze electrons.
- 1 8. (Amended) An electronic system, as recited in claim 7, wherein said transistor  
2 magnetically sensitive portion comprises a pair of magnetically permeable layers,  
3 wherein when said magnetically permeable layers are aligned said spin polarized  
4 electrons penetrate and when anti-aligned, said spin polarized electrons are  
5 attenuated.
- 1 9. (Withdrawn) An electronic system, as recited in claim 8, wherein said magnetically  
2 permeable layers are both located in said base.
- 1 10. (Original) An electronic system, as recited in claim 8, wherein one of said pair of  
2 magnetically permeable layers is located in said base and one of said pair of  
3 magnetically permeable layers is located in said emitter.
- 1 11. (Original) An electronic system, as recited in claim 5, wherein said emitter is tunnel  
2 coupled to said base across an insulator.

- 1 12. (Previously presented) n electronic system, as recited in claim 5, wherein said single  
2 device includes a buried quantum well within a semiconductor collector, wherein  
3 said quantum well is formed of a quantum well material having a lower band gap  
4 than adjacent material.
- 1 13. (Original) An electronic system, as recited in claim 12, wherein said material having  
2 a lower band gap has a direct transition for more efficient generation of light in said  
3 quantum well.
- 1 14. (Original) An electronic system, as recited in claim 12, wherein said semiconductor  
2 collector further comprises a Schottky contact region.
- 1 15. (Original) An electronic system, as recited in claim 14, wherein said semiconductor  
2 collector further comprises an n type Schottky contact region, an undoped quantum  
3 well region, and a p type substrate layer heterostructure.
- 1 16. (Previously presented) n electronic system, as recited in claim 12, wherein said light  
2 emitted by said single device comprises photons having an energy approximately  
3 equal to said band gap of said quantum well material.
- 1 17. (Previously presented) An electronic system, as recited in claim 5, wherein said  
2 emitter is capable of providing ballistic electrons across said base to said collector  
3 when an emitter-base bias is provided with a potential exceeding said energy barrier.
- 1 18. (Previously presented) An electronic system, as recited in claim 17, wherein said  
2 energy barrier comprises a base-collector Schottky barrier.

1 19. (Previously presented) An electronic system, as recited in claim 5, wherein said  
2 single device comprises a spin valve transistor having a source for complementary  
3 carriers and a place for recombining to generate said photons, wherein said energy  
4 barrier comprises a base-collector energy barrier.

1 20. (Previously presented) An electronic system, as recited in claim 19, wherein said  
2 base-collector energy barrier comprises a Schottky barrier, said source for  
3 complementary carriers comprises a p-type substrate layer, and said place for  
4 recombining comprises a quantum well.

1 21. (Withdrawn) An electronic system, as recited in claim 19, wherein said spin valve  
2 transistor includes a base having a first magnetically permeable layer and a second  
3 magnetically permeable layer.

1 22. (Withdrawn) An electronic system, as recited in claim 21, wherein said first  
2 magnetically permeable layer is ferromagnetic.

1 23. (Withdrawn) An electronic system, as recited in claim 21, wherein said second  
2 magnetically permeable layer has a lower coercive field level than said first  
3 magnetically permeable layer so said second layer can be switched without switching  
4 said first layer to provide for turning on and turning off current in said single device  
5 with an intermediate level magnetic field.

1 24. (Withdrawn) An electronic system, as recited in claim 23, wherein said spin valve  
2 transistor includes a base-collector contact comprising a Schottky barrier diode  
3 having a Schottky barrier height.

1 25. (Withdrawn) An electronic system, as recited in claim 24, wherein said Schottky  
2 barrier diode provides that only ballistic electrons having energy at least equal to said  
3 Schottky barrier height are injected into said collector.

1 26. (Withdrawn) An electronic system, as recited in claim 25, wherein said transistor  
2 comprises a variable emitter-base voltage and an independently variable collector-  
3 base voltage.

1 27. (Withdrawn) An electronic system, as recited in claim 26, wherein said transistor  
2 emits photons only when said emitter-base voltage exceeds a threshold  
3 approximately equal to the said Schottky barrier height.

1 28. (Withdrawn) An electronic system, as recited in claim 26, wherein said transistor  
2 emits photons only when said collector-base voltage exceeds a threshold  
3 approximately equal to the difference between bandgap of said collector and said  
4 Schottky barrier height.

1 29. (Withdrawn) An electronic system, as recited in claim 28, further comprising a first  
2 power supply for providing an electrical potential across a collector-base junction of  
3 said transistor, wherein when said electrons are injected into said collector over a  
4 Schottky barrier with an energy at least equal to energy of said Schottky barrier, the  
5 combination of this electron energy and said potential energy provided by said first  
6 power supply provides said electrons with enough potential energy to generate  
7 photons from recombination in said quantum well.

1 30. (Withdrawn) An electronic system, as recited in claim 29, further comprising a  
2 second power supply for providing an electrical potential across an emitter-base  
3 junction of said transistor, wherein said emitter provides ballistic electrons at an  
4 energy exceeding said Schottky barrier when sufficient emitter-base potential is  
5 provided.

1 31. (Original) An electronic system, as recited in claim 5, wherein said collector  
2 comprises an n type region and a p type region and a region-there-between, wherein  
3 said region-there-between has a lower band gap than either said n type region or said  
4 p type region so as to trap both electrons and holes for facilitating recombination and  
5 photon generation.

1 32. (Original) An electronic system, as recited in claim 31, wherein said region-there-  
2 between is undoped or lightly doped.

1 33. (Withdrawn) An electronic system, as recited in claim 5, wherein emitter-base  
2 contact comprises a second energy barrier.

1 34. (Withdrawn) An electronic system, as recited in claim 1, wherein said single device  
2 comprises a two-terminal light-emitting transistor, said two terminal transistor  
3 comprising a base and a collector, wherein said light is emitted from said collector,  
4 wherein said base of said two terminal transistor is exposed for receiving sub-band  
5 gap photons to provide internal photo-emission of charges in said base.

1 35. (Withdrawn) An electronic system, as recited in claim 1, wherein said single device  
2 is included in a magnetic read head, wherein said single device converts magnetic  
3 information into an optical signal.

- 1 36. (Withdrawn) An electronic system, as recited in claim 1, further comprising an array  
2 of said single devices for storing information and for converting said stored  
3 information into optical signals.
- 1 37. (Withdrawn) An electronic system, as recited in claim 1, wherein said single device  
2 further comprises amplification.
- 1 38. (Withdrawn) An electronic system, as recited in claim 1, further comprising a power  
2 supply, wherein said single device comprises a collector and a base, wherein said  
3 power supply is connected for providing a collector-base voltage sufficient to  
4 provide secondary electrons by impact ionization to provide amplification.

1 39. (Amended) An electronic system, comprising a metal base hot carrier transistor and a  
 2 source of external magnetic field, said metal base hot carrier transistor having a  
 3 metal base[[,]] and a collector, an interface there between, wherein and an energy  
 4 barrier, said energy barrier is between said metal base and said collector to block  
 5 thermalized carriers in said metal base, said collector having a quantum-well p region  
 6 and an n region for facilitating light emission, said metal base hot carrier transistor  
 7 further comprising a magnetically sensitive portion wherein said source of external  
 8 magnetic field is positioned to provide a magnetic field parallel to said interface  
 9 where said external magnetic field intersects said magnetically sensitive portion.

1 40. (Amended) An electronic system, as recited in claim 39, wherein said transistor  
 2 comprises a pair of ferromagnetic layers wherein a change in said external magnetic  
 3 field can switch magnetization orientation of one of said layers ~~can have its~~  
 4 ~~magnetization orientation switched~~ independently of the other layer to facilitate  
 5 magnetic switching between a first magnetic switch position and a second magnetic  
 6 switch position.

1 41. (Previously presented) An electronic system, as recited in claim 40, wherein a first  
 2 intensity of light is emitted in said first magnetic switch position and a second  
 3 intensity of light is emitted in said second magnetic switch position, wherein said  
 4 first intensity of light is greater than said second intensity of light.

1 42. (Withdrawn) An electronic system, as recited in claim 39, wherein said transistor  
 2 comprises ballistic spin filtering to spin polarize and analyze said carriers.

1 43. (Original) An electronic system, as recited in claim 39, wherein said metal base  
 2 comprises a ferromagnetic layer.

1 44. (Withdrawn) An electronic system, as recited in claim 39, wherein said metal base  
2 comprises a pair of magnetically permeable layers, wherein when said magnetically  
3 permeable layers are aligned spin polarized carriers penetrate and when anti-aligned,  
4 spin polarized carriers are attenuated.

1 45. (Withdrawn) An electronic system, as recited in claim 39, wherein said transistor is  
2 included in a magnetic read head, wherein said transistor converts magnetic  
3 information into an optical signal.

1 46. (Withdrawn) An electronic system, as recited in claim 39, further comprising an  
2 array of said transistors for storing information and for converting said stored  
3 information into optical signals.

1 47. (Withdrawn) An electronic system, as recited in claim 39, wherein said  
2 transistor further comprises amplification.

1 48. (Previously presented) An electronic system, as recited in claim 47, wherein said  
2 transistor comprises a power supply for providing a collector-base voltage sufficient  
3 to provide secondary electrons by impact ionization to provide said amplification.

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1 57. (Amended) An electronic system, as recited in claim 55, ~~wherein said spin filter~~  
2 ~~comprises a ferromagnetic layer located in said metal base 39, wherein a change in~~  
3 ~~said external magnetic field is capable of switching magnetization orientation of said~~  
4 ~~magnetically sensitive portion.~~

1 58. (Amended) An electronic system, as recited in claim 55 39, wherein said metal base  
2 hot carrier transistor comprises a pair of magnetically permeable layers, wherein  
3 when said magnetically permeable layers are aligned, hot carriers penetrate and when  
4 said magnetically permeable layers are anti-aligned, said hot carriers are attenuated,  
5 wherein said external magnetic field is capable of switching magnetization  
6 orientation to align and to anti-align said magnetically permeable layers

1 59. (Amended) An electronic system, as recited in claim 55 39, wherein said metal base  
2 hot carrier transistor further includes a spin filter, wherein said spin filter includes a  
3 pair of ferromagnetic layers, wherein a change in said external magnetic field can  
4 switch magnetization orientation of one of said ferromagnetic layers is capable of  
5 ~~having its magnetization orientation switched~~ independently of the other  
6 ferromagnetic layer to facilitate magnetic switching between a first magnetic switch  
7 position and a second magnetic switch position.

1 60. (Previously presented) An electronic system, as recited in claim 59, wherein a first  
2 intensity of light is emitted in said first magnetic switch position and a second  
3 intensity of light is emitted in said second magnetic switch position, wherein said  
4 first intensity of light is greater than said second intensity of light.

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1 64. (Previously presented) An electronic system, as recited in claim 1, further comprising  
2 an optical structure, wherein said optical structure is arranged to collect light emitted  
3 by said light emitting portion.

1 65. (Amended) An electronic system, as recited in claim 39, wherein said collector  
2 includes a quantum well, further comprising an optical structure, wherein said  
3 optical structure is arranged to collect light emitted by said quantum well.

1 66. (Amended) An electronic system, as recited in claim 39, ~~wherein said transistor~~  
2 ~~further comprises amplification 9~~, wherein said magnetically permeable layers are  
3 separated by a non-magnetically permeable spacer layer there between.

1 67. (Amended) An electronic system, as recited in claim 39, ~~wherein said transistor~~  
2 ~~comprises a power supply for providing a collector-base voltage sufficient to provide~~  
3 ~~secondary electrons by impact ionization to provide said amplification 44~~, wherein  
4 said magnetically permeable layers are separated by a non-magnetically permeable  
5 spacer layer there between.